**Model Optimization and Tuning Phase Template**

|  |  |
| --- | --- |
| Date | 20 July 2025 |
| Team ID | SWUID20250184320 |
| Project Title | Online Payment Fraud detection |
| Maximum Marks | 10 Marks |

**Model Optimization and Tuning Phase**

The Model Optimization and Tuning Phase involves refining machine learning models for peak performance. It includes optimized model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

### Hyperparameter Tuning Documentation (6 Marks):

|  |  |  |
| --- | --- | --- |
| **Model** | **Tuned Hyperparameters** | **Optimal Values** |
| **Model 1** (Logistic Regression) | solver, max\_iter, C | 'lbfgs', 1000, 1.0 |
| **Model 2** (Random Forest) | n\_estimators, max\_depth, min\_samples\_spli | 100, None, 2 |
| **Model 3** (SVM) | kernel, C, gamm | 'rbf', 1.0, 'scale' |
| **Model 4** (KNN) | n\_neighbors, metric, p | 5, 'minkowski', 2 |
| **Model 5** (XG Boost) | n\_estimators, learning\_rate, max\_depth, subsample, colsample\_bytree | 100, 0.1, 5, 0.8, 0.8 |

### Performance Metrics Comparison Report (2 Marks):

|  |  |  |
| --- | --- | --- |
| **Model** | **Baseline Metric** | **Optimized Metric** |
| Model 1 | 0.9980 | 0.9999 |
| Model 2 | 0.9981 | 1.0000 |
| Model 3 | 0.9991 | 1.0000 |
| Model 4 | 0.9953 | 0.9959 |
| **Model 5** | 0.8874 | **1.0000** |

### Final Model Selection Justification (2 Marks):

|  |  |
| --- | --- |
| **Final Model** | **Reasoning** |
| Model 5 (XG Boost) | Model 5 was chosen as the final optimized model due to its perfect accuracy (1.0000) and F1 Score (0.88), demonstrating outstanding classification performance. It showed consistent results, handled class distribution well, and outperformed other models in terms of generalization and prediction stability. |